C32-20' PM1000 DUAL VOLTAGE DUAL FREQUENCY SOUND ATTENUATED POWER MODULE

50/60 Hz

Image shown may not reflect actual package

FEATURES

Factory designed, certified prototype tested with torsional analysis. Production tested and delivered in a package that is ready to be connected to your fuel and power lines. Electric Power Design Pro computer sizing available. Supported 100% by your Caterpillar dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set is designed and manufactured in an ISO 9001:2000 compliant facility. Generator set and components meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO8528, NEMA MG1-22

CATERPILLAR SR4B GENERATOR

Two bearing, wye-connected, static regulated, brushless permanent magnet excited generator designed to match the performance and output characteristics of the Caterpillar diesel engine that drives it.

RELIABLE, FUEL EFFICIENT DIESEL ENGINE

The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

CATERPILLAR COOLING SYSTEM

Sized compatible to rating with energy efficient fan and core.

CATERPILLAR GENERATOR PARALLELING CONTROL

Single unit and/or utility paralleling components. Circuit breakers, bus bars, and connection panel ready to connect.

EXCLUSIVE CATERPILLAR DIGITAL VOLTAGE REGULATOR (CDVR)

Three-phase sensing and adjustable volts-per-hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

ENVIRONMENTALLY FRIENDLY

110% full spill containment of all onboard fluids.

SOUND TREATED CONTAINER

For ease of transportation and protection. Meets 87 dB(A) at 7 m or below per SAE J1074 measurement procedure.

FACTORY INSTALLED STANDARD EQUIPMENT

SYSTEM	STANDARD EQUIPMENT
Engine	EPA approved Tier 2 C-32 Caterpillar engine Heavy duty air cleaner with pre-cleaner and service indicator 45-Amp charging alternator Fuel filters – primary and duplex secondary with integral water separator and change-over valve Lubricating oil system, jacket water heater, fuel cooler and priming pump Electronic ADEM™ A4 controls
Generator	Dual voltage (480/400V), dual frequency (60/50 Hz) SR-4B brushless, permanent magnet excited, three-phase with digital voltage regulator, space heaters, 12-lead design, and Class H insulation operating at Class F temperature for extended life
Containerized Module	20' ISO standard cube container, CSC certified 2-axle, 20' ISO container chassis Sound attenuated air intake louvers and 2 lockable personnel doors with panic release Cam-lock access door, color-coded cam-lock design load connections Shore power connection via distribution block connections for jacket water heater, battery charger, space heaters, and generator condensate heaters Standard lighting 2 AC/2 DC, one (1) single duplex service receptacle, 2 external break-glass emergency stop buttons Fuel tank UL listed 8 hr runtime @ 75% load Sound attenuated 87 dB(A) @ 7 m, spill containment 110% of all onboard fluids Oversized maintenance-free battery, battery rack and 20-Amp battery charger Critical grade internally insulated exhaust silencer Vibration isolators, corrosion resistance hardware and hinges External drain access to standard fluids Standard Cat rental decals and painted standard Cat power module white
Cooling	Standard cooling provides >45° C ambient capability (50 Hz) or 43° C (60 Hz) at prime +10% rating Engine mounted, 38 split JW/CAC vertical radiator, vertical discharge, fuel cooler and roof fill door
Generator Paralleling Control	Custom paralleling control with EMCP 3.3 components automatic start/stop with cool down timer Protection: 32, 59, 27, 40, 810, 81U, 40, complete with device 15, 25, 65 & 90 Reverse compatibility module provided for interface to legacy power modules Touch screen control and with event log Multi-mode operation (island and multi-island) and load sharing (multi-unit only) Touch screen display (status and alarms) 2,000-Amps circuit breaker, UL listed, fixed mounted, electrically operated, 3-phase, 50% rated neutral bus Metering display: voltage, current, frequency, power factor, ekW, WHM, kVAR, and synchroscope
Quality Units will not be CSC certified.	Standard genset and packaged factory tested UL, NEMA, ISO and IEEE standards O&M manuals

SPECIFICATIONS

CAT SR4B GENERATOR

Frame Size 693
Excitation . . . . . Static regulated brushless PM excited
Constructions . . . . . Two bearing, close coupled
Insulation . . . . . Class H
Enclosure . . . . . Drip proof
Alignment . . . . . Pilot shaft
Overspeed capability – % of rated . . . . . 130% of rated
Wave deviation form 2%
Voltage regulator . . . . . 3 phase sensing with Volts-per-Hertz
Voltage regulation . . . . . Less than ±½% Voltage gain
Adjustable to compensate for engine speed droop and line loss
Wave form . . . . . Less than 5% deviation
Telephone Influence Factor (TIF) . . . . . Less than 50
Harmonic Distortion (THD) . . . . . Less than 3%

CAT C32 DIESEL ENGINE

C32 TA, V-12, 4-Stroke diesel
Bore – mm (in) 145 (5.71)
Stroke – mm (in) 162 (6.38)
Displacement – L (cu in) 32.10 (1,958.86)
Compression ratio 15:1
Aspiration . . . . . TA
Fuel system . . . . . MEUI
Governor Type . . . . . Caterpillar ADEM™ A4 Control System

TECHNICAL DATA

		C32-20' PM1000
Power Rating		**Prime**
50 Hz	ekW (kVA)	728 (910)
60 Hz	ekW (kVA)	910 (1,137)
Engine and Container Information		
Engine model		C32
Container size	m (ft)	6 (20)
Container dimensions	mm (in)	Length – 6096 (240)
	mm (in)	Width – 2438 (96)
	mm (in)	Height – 2596 (102)
Fuel Capacity	L (gal)	1893 (500)
Operation at 75% Load Factor	hours	8 (approx.)
Approximate Weight – with Generator Set and Paralleling Control		Dry/Wet
Including container	kg (lb)	12 020 (26,500)/13 290 (29,300)
With optional undercarriage	kg (lb)	14 741 (32,500)/16 011 (35,300)

STANDARD CONTROLS

6 m (20 ft) CONTAINER
400V/50 Hz – 480V/60 Hz

Caterpillar utility paralleling controls are intended for automatic or manual paralleling with a utility power source as a load management system, with provisions for standby operation feeding an isolated load network. Load management operation involves microprocessor-based automatic loading controls with soft loading, base load, Import/Export control and soft unloading. For Standby operation, the generator operates as an isochronous machine isolated from the utility supply. The controls allow for automatic operation, initiated locally or remotely by the customer's SCADA system. Detailed modes of operation are listed below.

SINGLE UNIT ISLAND AND MULTI-UNIT ISLAND OPERATION

1. Utility Standby Mode (Normal)
   a. The utility is providing power for the plant loads.
   b. The Power Module Generator mains are open.
   c. The automation is standing by to act in response to a utility failure.
2. Emergency Mode (Emergency)
   a. Utility Failure (Enter Emergency)
      1) The customer protective relaying senses a utility abnormal condition.
      2) A run request is sent to the Power Module Generator plant.
      3) The first Power Module Generator up to voltage and frequency is closed to the bus.
      4) In Multi-Unit Island Mode, the remaining Power Module Generators are synchronized and paralleled to the bus as they come up to voltage and frequency. This function is performed via the MODBUS Plus data link connected between the Power Modules.
      5) Plant load is transferred to the Power Modules, which will share load equally via MODBUS Plus data link.
      6) The system is now in Emergency Mode.
   b. Utility Restoration Mode (Emergency Exit/ Return to Normal)
      1) The customer protective relaying senses the utility conditions are within acceptable functional limits.
      2) Following the return to normal time delay, the plant load is transferred to the utility.
      3) After all plant load is returned to the utility, the customer run request is removed from the Power Module Generator plant.
      4) The generator mains are opened, and the Power Module Generators will run for the programmed cooldown time and then stop.
      5. The system is now in Automatic Standby Utility Mode (Normal).
3. Multi-Unit Island Generator Demand Priority Control (Emergency Gen Demand)

The System Controls will include a Generator Demand Priority Control function to automatically match the on-line Power Module Generator capacity to the loads in order to avoid unnecessary operation of all the Power Module Generators when the plant loads are low.

The following controls will be provided for each Power Module Generator.

a. User-settable Generator Priority Selector
b. Status indicator for the Generator Priority selected
c. Status indicator for Power Module Generator on-line or off-line.
d. Generator Demand Priority Control Switch (On/Off)
e. User-settable Generator Remove Level (% as a function of single generator capacity)
f. User-settable Generator Remove Time Delay
g. User-settable Generator Add Level (% as a function of single generator capacity)
h. User-settable Generator Add Time Delay

Upon entrance into Emergency Mode, all generators will be started and paralleled to the bus. After the Remove Time Delay, Power Module Generators will be removed from the bus as a function of the generator percentage loading. Generators will be removed from the bus in descending priority order.

Should the generator percentage loading increase to the user-selected Generator Add Level after the user-selected Generator Add Time Delay, the next priority generator will be started, synchronized and paralleled to the bus. Should the Power Module Generator plant ever reach 100% loading, the next priority generator will be started and added to the bus, bypassing the Generator Add Time Delay.

SINGLE UNIT IMPORT, EXPORT OR BASE LOAD OPERATION

During periods of peak demand the system may be placed in operation using the PowerLynx operator interface panel on the front of the paralleling control.

1. Entry – Local
   a. The operator places the System Control Switch into Load Management on the PowerLynx operator interface panel.
   b. The operator selects Import, Export or Base Load Operation on the PowerLynx operator interface panel.
   c. The Load Management Setpoint is the amount of power Imported, Exported or Base-Loaded. A 4-12-20mA signal is provided by the customer and is linearly proportional to the utility load, with 12mA equaling 0 ekW. The 4-12-20mA utility load signal is wired to one and only one Power Module. If the Power Module selected for Load Management is not available, the 4-12-20mA signal will be wired to a different Power Module.
   d. The operator sets the Load Management Setpoint and Power Factor Setpoint.
   e. A Run request signal is received by the Single Unit Power Module.
   f. The Power Module Generator is cranked and started and will run for a predetermined warm-up time before it is synchronized and paralleled to the utility.
   g. When the generator is on the bus, it is soft-ramp-loaded until the generator output reaches the Load Management Setpoint.
   h. The generator output is dynamically adjusted to maintain the Load Management Setpoint.
   i. Should the utility fail during Load Management Operation, the Protective Relay will cause the Paralleling Circuit Breaker 52G to open and be locked out until the Lockout Relay is manually reset by an operator on site. The generator is allowed to run for the duration of the cooldown time.
2. Exit – Local
   a. The operator places the System Mode Switch into Automatic.
   b. The generator is soft-ramp-unloaded until the plant load is fully supported by the utility.
   c. The Paralleling Circuit Breaker 52G is opened.
   d. The generator is allowed to run for the duration of the cooldown time.

GENERATOR SET EMCP 3.3 LOCAL CONTROL PANEL

- Generator mounted EMCP 3.3 local control panel
- Provides MODBUS datalink to paralleling control for monitoring of engine parameters
- Convenient service access for Caterpillar service tools (not included)
- The Caterpillar EMCP 3.3 places fully featured power metering, protective relaying and engine and generator control and monitoring at your fingertips.
- Integration with the CDVR provides enhanced system monitoring.
- Ability to view and reset diagnostics of all controls networked on J1939 datalink.
- Network modules via the control panel removes the need for a separate service tool for troubleshooting.
- Fully featured power metering, protective relaying, engine and generator parameter viewing, and expanded AC metering are all integrated into this controller.
- Fuel level monitoring and control
- Real-time clock allows for date and time stamping of diagnostics and events.

EMCP 3.3 ENGINE OPERATOR INTERFACE

- Graphical display with positive image, transflective LCD, adjustable white backlight/ contrast.
- Two LED status indicators (1 red, 1 amber).
- Three engine control keys and status indicators (Run/Auto/Stop).
- Lamp test key
- Alarm acknowledgement key.
- Display navigation keys
- Two shortcut keys: Engine Operating Parameters and Generator Operating Parameters.

GENERATOR PARALLELING CONTROLS

Modes of operation are field configurable and include:

- Single unit island mode
- Multiple unit island mode
  - Includes Load Sense/ Load Demand control
  - Load sharing capability is provided via network communication
- Single unit utility parallel mode
  - Selectable for Import/Export control
  - If import control is selected a 4-12-20mA signal is required and will be provided by others that is scalable to the utility contribution
- 6 inch black and white HMI touch screen

- Reverse compatibility module provided for interface to legacy designed Power Module paralleling control. Includes PLC, load share and voltage droop. 50/60 Hz selectable.

Incoming Utility Breaker Status Circuit
Circuit to accept customers contact from remote utility disconnect device. Customer to provide a normally open form 'a' contact to indicate when the local load network is connected to the utility grid.

Utility Transfer Trip Circuit
Circuit accepts input (normally open dry contact) from customer's system protective relay(s) or other controlling device. Operation of contacts causes tripping of the generator circuit breaker via the generator (software) 86 lock-out function and places the engine in cooldown mode. Circuit is disabled when operating in single unit or multiple unit island.

GENERATOR PARALLELING CONTROLS OPERATOR INTERFACE

Graphical mimic one line diagram that shows generator with its respective circuit breaker in a one-line representation of the system. The graphics utilize black and white indicators and bar graphs while actively displaying the following information:

- Utility CB Open/Closed. Input contacts provided by others.
- Utility ekW 4-12-20mA signal required and provided by customer that is scalable to the utility contribution.
- Generator CB Open/Closed/Tripped
- Generator Volts/Amps/ekW/Frequency
- Engine Stopped/Running/Cooldown/Pre-Alarm/Shutdown
- Engine ECS Position Stop/Auto/Run
- Utility Output ekW
- System Summary Alarm

Event logging is also included with up to 500 stored events.

GENERATOR METERING AND PROTECTION

Generator metering that will graphically display 3Ø Voltage, 3Ø Current, Frequency, Power Factor, ekW, kVAR and a Synchroscope Display of EMCP 3.3 faults, CDVR or ADEM A3 and A4 will be provided via MODBUS RTU interface to EMCP 3.3.

Generator/Intertie Protective Relaying including:

- Device 27/59 – Under/Over Voltage
- Device 81O/U – Under/Over Frequency
- Device 40 – Loss of Excitation
- Device 32 – Reverse Power
- Device 25 – Synchronizing Check
- Device 15 – Auto Synchronizer
- Device 65 – Governor Load Sharing, Soft Loading Control
- Device 90 – VAR/PF and Cross Current Compensation Controller

Two form C run contacts included for motor starters. AC distribution cabinet – includes circuit breakers, and/or motor starters for battery charger, fuel transfer pump, AC lighting, generator space heater, convenience receptacles and jacket water heaters

PROGRAMMING AND DIAGNOSTICS

Includes field programmable set points for engine control and monitoring variables and self-diagnosis of the EMCP 3.3 system component and wiring failures.

ALARM MODULE

Flashing LED warnings for

- low coolant temperature
- high coolant temperature (pre-alarm)
- low oil pressure (pre-alarm)
- engine control switch not in automatic
- low DC voltage

Includes an alarm horn and acknowledge pushbutton.

ENGINE CONTROL SWITCH

Keypad selectable, three (3) positions:
Stop, Auto, Run

- Stop for engine shutdown and resetting faults
- Auto for local or remote automatic operation, when initiated by switch operation or contact closure
- Run for local starting and manual paralleling.

CIRCUIT BREAKER CONTROL SWITCH

Heavy duty, three (3) position spring return to center with momentary trip and close position, and slip contacts for automatic closing. Includes circuit breaker position indicating lamps.

EMERGENCY STOP PUSHBUTTON

Mushroom head, twist to reset, causes engine shutdown and tripping of the generator circuit breaker. Prevents engine starting when depressed.

CIRCUIT BREAKER

2000A fixed type, 3 poles, generator set mounted, electrically operated, insulated case circuit breaker with solid state trip unit for overload (time overcurrent) and fault (instantaneous) overcurrent protection. Includes DC shunt trip coil activated on any monitored engine or electrical fault, 100 KA-interrupting capacity at 480 VAC.

ELECTRONIC LOAD SHARING GOVERNOR

Includes speed adjustment, and auto load share capability.

AUTOMATIC/MANUAL PARALLELING

Automatically synchronizes and parallels the generator with another power source. Includes provisions for manual permissive paralleling.

VOLTAGE REGULATION AND POWER FACTOR CONTROL CIRCUITRY

Standard Caterpillar generator mounted automatic voltage regulator, microprocessor base with manual raise/lower voltage adjust capability and VAR/power factor control circuitry for maintaining constant generator power factor while paralleled with the utility. Includes RFI suppression, exciter limiter and exciter diode monitoring. Voltage and power factor adjustments are performed on the setting screen of the HMI touch screen.

CURRENT TRANSFORMERS

CT's rated 2500:5 with secondaries wired to shorting terminal strips.

POTENTIAL TRANSFORMERS

4:1 ratio with primary and secondary fuse protection.

QUICK DISCONNECT CAM-LOCK CONNECTION

Color-coded quick disconnect cam-lock design for easy connection of customer load cables

AC DISTRIBUTION

Transformer distributes utility voltage for the 16 spaces (minimum) Power Module AC panel board. Provides 240/120 VAC for all module accessories. Includes controls to de-energize jacket water heaters and generator space heater when the engine is running.

SHORE POWER PLUGS

One (1) shore power connection distribution block for jacket water heaters, generator space heater and battery charger. Includes fault protection and relays to de-energize jacket water heaters and generator space heater when the engine is running.

INTERNAL LIGHTING

Two (2) internal DC lights with one (1) timer installed at each side of the container door. Also includes two (2) internal AC lights. One (1) single duplex service receptacle.

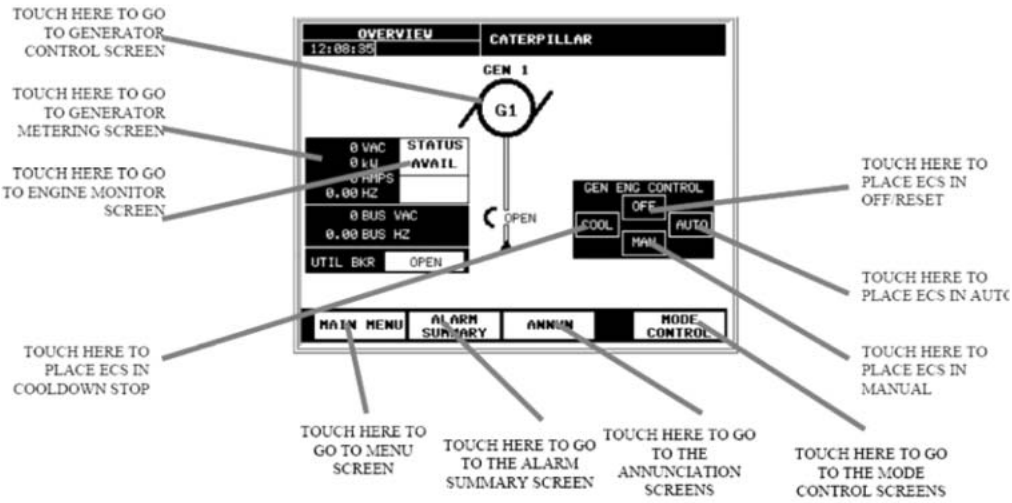
BATTERY CHARGER

24 VDC/20A battery charger with float/equalize modes and charging ammeter.

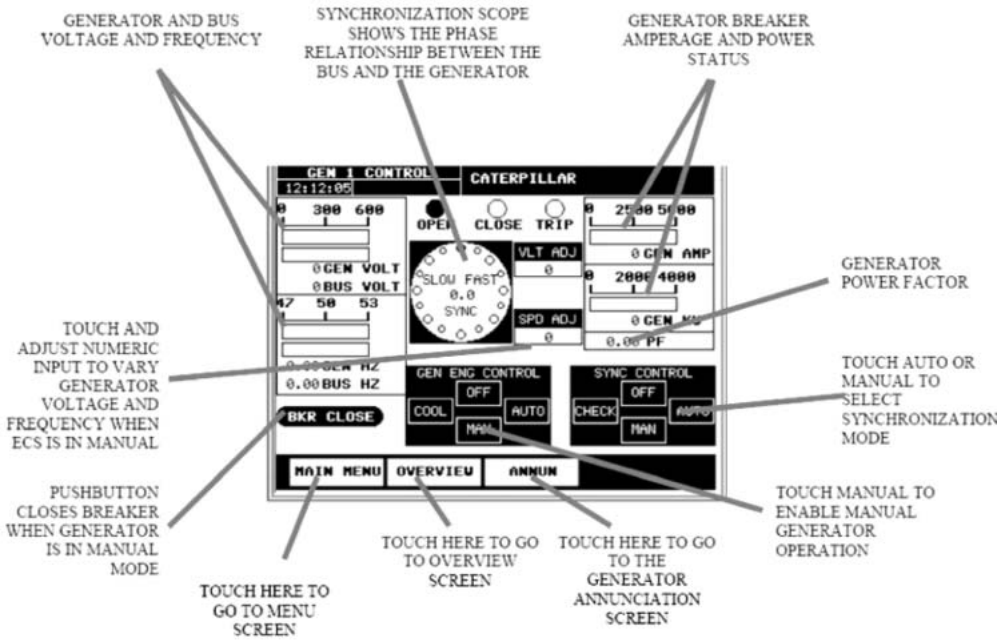
HUMAN MACHINE INTERFACE (HMI) HIGHLIGHTS

- Engine/Generator functions are performed thru the 6" HMI touch screen interface.
- See next two pages for highlights of its capability and function.

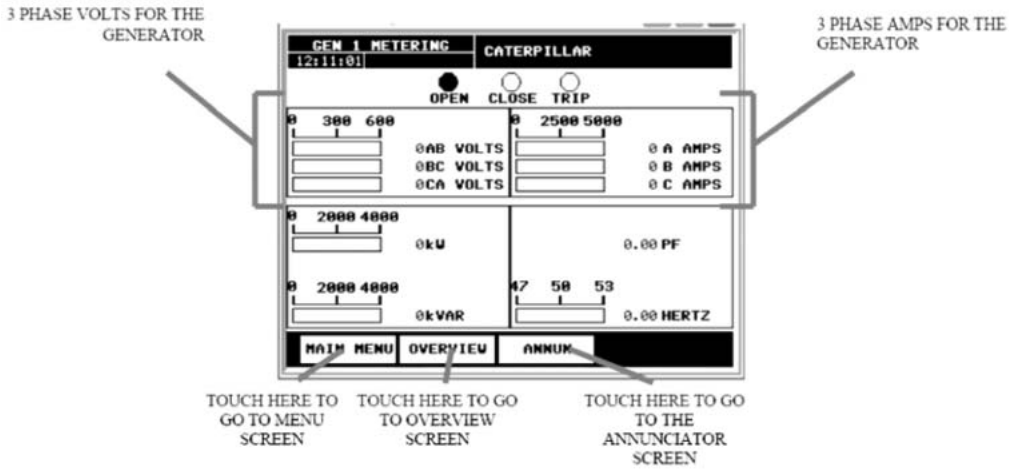
Overview Screen (Typical)
Shows the generator status, generator metering data, bus metering data, ECS position, generator/utility breaker status.



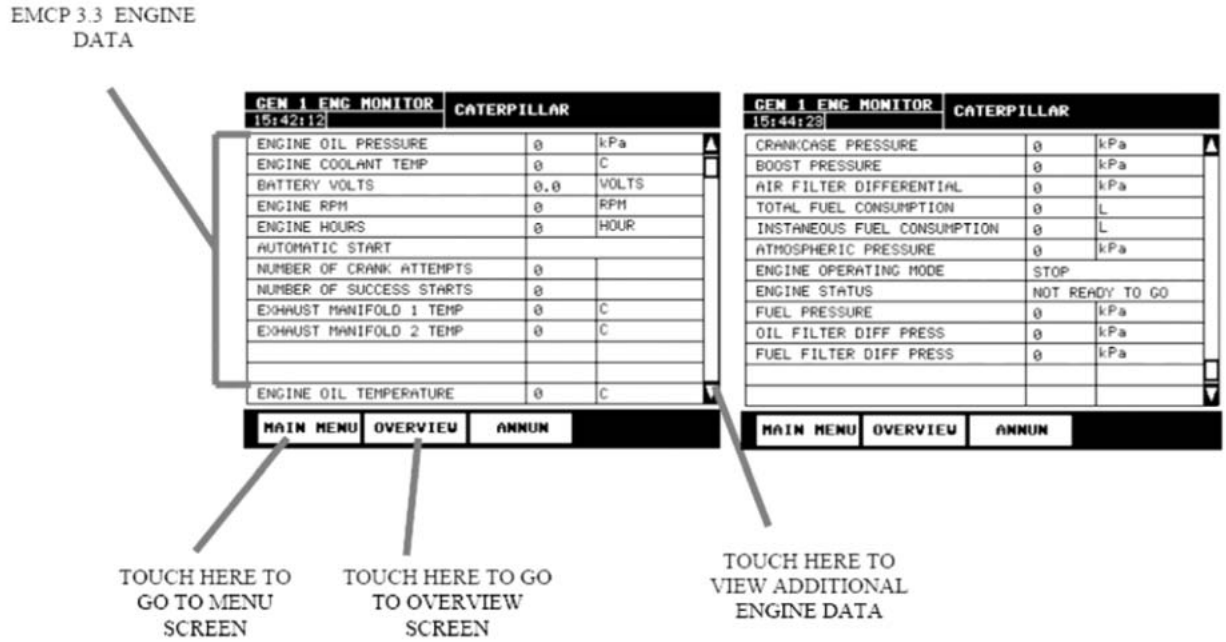
Generator Control Screen (Typical)
It allows the operator to observe the automatic synchronization and transfer of the load to and from the generator. Engine control allows the operator to run the engine in manual, or switch generator modes. Voltage and frequency offset adjustment allows the operator to control generator frequency and voltage.



Generator Metering Screen (Typical)
Allows the operator to view three phases of voltage and amperage for the bus and the generator.



Engine Monitoring Screen (Typical)
Engine status is obtained directly from the EMCP 3.3. Engine starts and total hours can be used by the operator to determine when regular preventive maintenance is required. Other metering is an indication of such things as engine battery and oil filter health.



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